

# Capturing the ICT Dividend:

Using technology to drive productivity and growth in the EU



A white paper produced in collaboration with AT&T

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**Andrew Edison**  
Regional Vice President  
for EMEA, AT&T

## Foreword from AT&T

### **Productivity is the cornerstone of economic growth.**

In Europe today, low economic growth and the international financial crisis are clouding the outlook for all companies. Now, more than ever, improving productivity and becoming more competitive is the only route for many businesses to grow.

We at AT&T believe that information and communication technology (ICT) is a fundamental driver of productivity improvements.

However, the impact of ICT has not always been clear. For many years, economists struggled to see any statistical evidence that ICT improved productivity. Now we know it has an impact, but that impact is uneven, varying widely from industry to industry and country to country.

Why is that? Where does ICT have the greatest impact? Where does it have surprisingly little impact? How important is it compared with other factors affecting productivity? Why are some companies better at using ICT than others? Why do some countries see greater returns from ICT investment?

AT&T commissioned this report to start answering these questions. Oxford Economics has conducted an independent and exhaustive analysis of economic data, academic research and one-on-one interviews with executives and policymakers to draw its conclusions.

Our aim is to provide information that can demonstrate the returns on ICT investments, and quantify what gains may be made from ICT in the future. Importantly, the report will address what other investments need to be made alongside ICT to make it effective. The report will also examine the role of governments, and explore the optimal regulatory framework to allow ICT investments to pay off.

We hope this report can help companies and governments make decisions that will drive economic growth.

As always, there will be lively debate about the best way forward. We do not expect to provide all the answers here, but we hope to start a discussion. I invite you to participate in that discussion with us at [www.corp.att.com/bemoreproductive](http://www.corp.att.com/bemoreproductive), or search for “Be More Productive” to find our group on [www.linkedin.com](http://www.linkedin.com).

At AT&T, productivity is at the heart of what we do. We are here to help everyone be more effective and more efficient, cut their costs, increase their output, and compete more strongly on the world stage.

We hope you enjoy the report.

A handwritten signature in blue ink, appearing to read 'And', followed by a long horizontal flourish.

**Andrew Edison**  
Regional Vice President for EMEA, AT&T

# Executive Summary

- ICT has driven productivity and growth in developed countries over the past two decades.
- Investment in ICT generates a bigger return to productivity growth than most other forms of capital investment. This “ICT Dividend” is estimated to contribute around one-third of the overall returns on ICT investment of 20% to 25%.
- The “ICT Dividend” depends on accompanying investments in intangible capital (such as organisational restructuring and employee know-how), and the local policy and regulatory framework.
- Europe has fallen behind the world leader in investment in ICT—the US—since 1991. The US increased its accumulated stock of ICT investment as a proportion of GDP from 9% in 1991 to 30% in 2010. Europe’s ICT capital stock increased from 6-9% (near parity with the US) to around 20% over the same timeframe.
- The ICT investment disparity significantly affected Europe’s relative productivity. From 2000-2010, annual US productivity growth accelerated to close to 2%. In Europe, annual productivity growth decelerated to around 1%—half the US level.
- Had Europe matched the US in its productivity growth since the mid-1990s, the gap in living standards would today be 25% smaller, equivalent to an improvement in Europe’s GDP per head of just under €3,400.
- The European productivity leaders are Scandinavia and the UK, which have invested most in ICT and have market conditions favourable to exploit it. Over the past 15 years, they have seen average labour productivity growth of between 1.7% and 2% a year.
- Italy and Spain have made least effective use in Europe of ICT to drive productivity. Since 1995, annual labour productivity has averaged only 0.3% and 0.8% for Italy and Spain, respectively.
- By raising its ICT investment, Europe could see significant economic growth and an “ICT Dividend” from accompanying productivity growth. If by 2020 Europe built its ICT capital stock to the same relative level as the US, EU GDP would increase by 5%, equivalent to about €760 billion at today’s prices, or around €1,500 per person. For countries experiencing sluggish growth—such as Spain and Italy—the impact on GDP could be more than 7%, or over €100 billion.
- Government policy influences ICT development, returns on ICT investment and the ability to generate productivity benefits. European governments would see considerable economic growth by prioritising ICT policy more effectively in their economic plans.
- If Europe does not address its productivity, it will not only fail to deliver its full potential, but will also risk losing ground to emerging economies. The share of firms in the emerging economies planning to increase their investments in productivity-linked technologies by more than 20% over the next 5 years is twice as high as in Europe.

# Glossary and Terminology

## Information and Communications Technology (ICT)

ICT embraces telecommunications (telephone lines and wireless signals), management systems, and audio-visual systems. ICT consists of all technical means to handle information and aid communication, including computer and network hardware, middleware and software.

## Capital Deepening

Capital deepening refers to improvements to a firm's "capital stock"—the entirety of a firm's assets. In addition to tangible assets such as property, plants, and equipment, capital stock embraces less tangible assets like software, and intellectual property such as patents, know-how, and research and development, along with a firm's brands and trademarks. Capital deepening can reflect either an increase in the size of capital stock, or improvements in its quality as older equipment is replaced with newer models that embody advances in technology and improved design.

## Intangible Capital

Capital refers to the outcome of any investment, a commitment of current resources with the expectation of future returns. Intangible capital refers to "softer" assets that are harder to quantify. For example, leading firms that have built up knowledge over time on how to use ICT effectively possess intangible capital. The intangible capital in this ICT example is not measured in the productivity statistics. As a result, its contribution to productivity is recorded in the productivity statistics as part of Total Factor Productivity.

## Total Factor Productivity (TFP)

An improvement in TFP implies a decline in a firm's average cost in producing a given output that cannot be explained by changes in either the prices of capital goods or wages. TFP includes technical know-how, improvements in business organisation, and managerial efforts that reduce total costs. In the statistics, TFP is measured as a residual and any errors in measuring output, labour, or capital will end up in measured TFP. This is the case, for instance, for some types of intangible capital.

## Labour Productivity

The amount of output produced in a given period of time (usually a year), divided either by the size of the workforce or by the total number of hours worked. Growth in labour productivity is attributable to three influences: (1) improvements in workforce skills and education, (2) capital deepening, and (3) total factor productivity.

## EU15

The EU15 comprises: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and the UK.

## The "ICT Dividend"

Investment in ICT enables the economy to be more productive and to generate a higher level of GDP. This extra GDP will be generated over a number of years as that ICT capital is operated.

As part of our return on investment (ROI) analysis, we measured the extent to which ICT investment raises GDP over-and-above the value of the capital investment. The amount was expressed as an annual real rate of return on that investment. Our research shows that investment in ICT generates a bigger return to productivity growth than most other forms of capital investment. While the returns on other forms of capital investment are about 15% on average, we estimate the ROI on ICT investments to be typically between 20-25%.

The "ICT Dividend" is estimated to contribute one-third of the overall returns on ICT investment, or about 7-8 percentage points. So, according to our analysis, investing in ICT rather than other capital investments may boost ROI by as much as 50%.



# Introduction

From the beginning of the information age, efforts to measure the value of ICT investment relative to productivity and growth have been met with frustration. Nobel Laureate Robert Solow wrote in 1987, “You can see the computer age everywhere but in the productivity statistics.”<sup>1</sup> A decade later, Erik Brynjolfsson, the Schussel Family professor of management at MIT’s Sloan School of Management and director of the MIT Center for Digital Business, coined the term “productivity paradox”<sup>2</sup> to describe the stubborn gap between anecdotal evidence and hard data on ICT investment and productivity.

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*“You can see the computer age everywhere but in the productivity statistics.”*

*Robert Solow, Nobel Laureate*

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By the early 2000s, economists such as Dale Jorgenson and Kevin Stiroh<sup>3</sup> found evidence to support a link between ICT investment and industrial productivity. They traced a sharp pickup in US productivity during the 2000s to increased investment in ICT that had been made during the second half of the 1990s. It had been recognised for some time that ICT producers were achieving significant productivity gains through rapid technological advances such as exponential improvements in chip technology. What was new, though, was evidence that heavy end-users of ICT were also experiencing a productivity resurgence, notably in service sectors such as big-box retailers and financial services firms.

In a 2005 speech<sup>4</sup>, Ben Bernanke, then a governor of the US Federal Reserve’s board and now the central bank’s chairman, linked the tech boom with prosperity from 1995 to 2001. He cited average productivity gains of about 2.5% a year between 1995 and 2001, a big improvement over the previous 25 years, when productivity gains averaged only 1.5%. He credited this increase to the adoption of new technologies.

Building on these investments, US productivity gains accelerated after the 2001 “dot-com bust” to just under 2% annually, even in the midst of upheaval marked by slumping stocks, corporate scandals, and the September 11 terrorist attacks in the US. These robust technology-driven productivity gains reversed a post-World War II trend: they widened the productivity gap between the US and Europe, which had been closing until the mid-1990s. Chart 1 highlights the extent of this gap and how it is widening: since 1995, Europe has achieved annual productivity growth averaging only 1.2%.

1 [http://www.brookings.edu/articles/1999/04technology\\_triplett02.aspx](http://www.brookings.edu/articles/1999/04technology_triplett02.aspx)

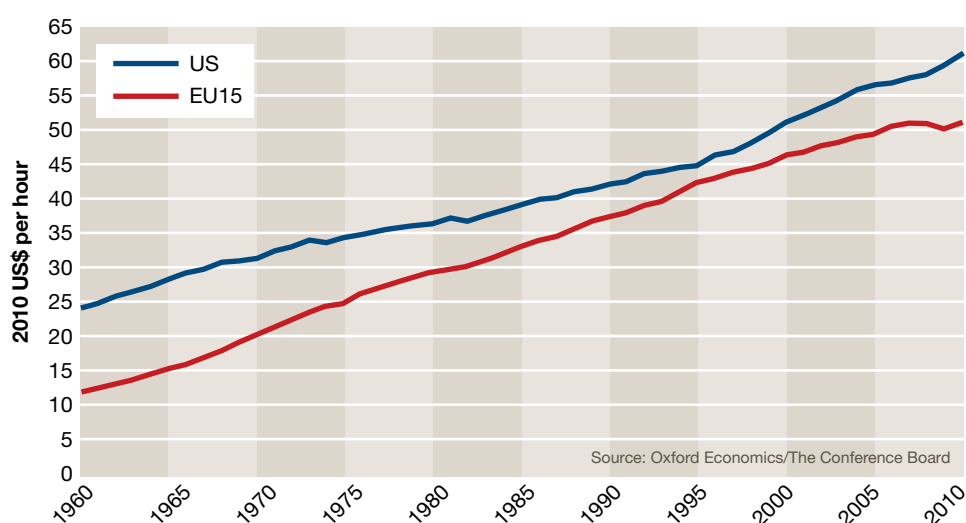
2 <http://ccs.mit.edu/papers/CCSWP130/ccswp130.html>

3 Jorgenson, D, and Stiroh, K, (2000), “Raising the speed limit: US economic growth in the information age,” *Brookings Papers on Economic Activity*, 1, pp 125-211.

4 <http://www.federalreserve.gov/boarddocs/speeches/2005/20050119/default.htm#fn1>

It is now clear that ICT investment has played a decisive role in creating this productivity gap. In 1991, the stock of ICT (the value of all ICT equipment in use by businesses) as a proportion of GDP was similar—roughly 9% in the US, and between 6% and 9% in most European countries. By 2000, the US had pulled away—the ICT capital stock there rose to above 21% of GDP during the dot-com investment boom. While the UK kept pace (ICT capital stock rose to 19% of GDP), the ICT capital stock in the rest of Europe only rose to between 12% and 15% of GDP. The latest data suggest this ICT capital stock gap remains substantial (30% for the US compared with around 20% for the EU), further affecting European productivity growth rates.<sup>5</sup> The financial downturn and significant budgetary strain it has created for firms in Europe and other advanced economies could lead to additional cuts in technology spending, making this gap wider still.

**Chart 1: Average labour productivity in Europe and the US**



Yet while the scale of investment is important, it is not the whole story. European companies, after all, have access to the same technologies as US firms. Investments in intangible capital that provide the supporting framework for ICT to be effective are equally, if not more, important. The policy environment in which ICT investment decisions are made and companies subsequently operate is also critical. We examine these areas in more detail in the report.

Europe's underperformance in ICT-based productivity compared with global peers has meant a significant loss for Europe in terms of economic growth and competitiveness. For example, had Europe matched the US in its productivity growth since the mid-1990s, the gap in living standards between the two areas would by today be 25% smaller, equivalent to an improvement in Europe's GDP per head of just under €3,400.

Firms in fast-growing emerging markets, meanwhile, are investing aggressively in ICT. According to previous research conducted by Oxford Economics, when compared with firms in advanced economies, twice as many firms in developing economies plan to increase their investments in mobile devices, social media, business intelligence, collaborative tools, and telepresence systems by more than 20%.<sup>6</sup> Furthermore, they are taking advantage of the lessons learned from

<sup>5</sup> Source, EU KLEMS

<sup>6</sup> "The New Digital Economy: How it will transform business," Oxford Economics, June 2011 [http://www.oxfordeconomics.com/free/pdfs/the\\_new\\_digital\\_economy.pdf](http://www.oxfordeconomics.com/free/pdfs/the_new_digital_economy.pdf)

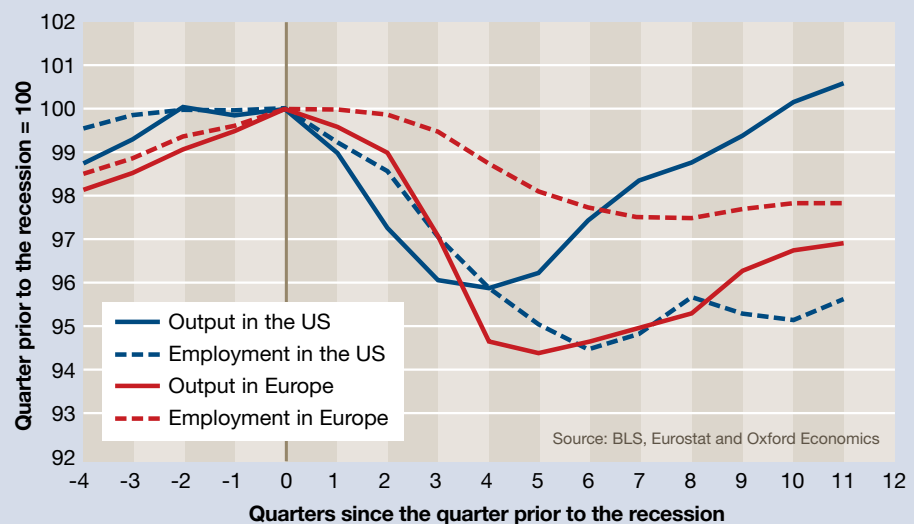
their rivals in advanced economies, allowing them to create flexible organisational structures and reap the benefits of their investments far more quickly than their counterparts in the developed world. If Europe does not address its productivity gap, it will not only fail to catch up with the US but also will risk losing greater ground to emerging economies.

Our study looks in detail at the wide productivity gap that exists between European markets and the US, and how ICT investment—along with investment in intangible capital and well-directed government policy—can help close the gap.

## Productivity data and the financial crisis

While firms that have continued to invest in ICT during the recession are likely to have gained an edge over their competitors, these gains will not, in general, be detected in the productivity statistics. ICT investments boost productivity directly through capital deepening and indirectly through raising total factor productivity (TFP). Yet during the recession, other factors, such as labour retention policies, have obscured the positive role played by ICT (see Chart 2 below).

**Chart 2: Output and employment in the latest recession**



The chart shows the change in output and employment since the start of the recession, for Europe and the US. In the US, output and employment fell together during the first four quarters of the recession, before the economy experienced a “jobless recovery” during the following two years. Output in Europe fell further and recovered by less, yet to date employment has remained relatively stable. As a result, productivity growth over the last three years has been very strong in the US and relatively weak in Europe.

These striking differences, while saying much about the culture and legal frameworks at work in Europe and the US, obscure the benefits that flow from ICT investments. Moreover, the analysis of variations in labour productivity during the recession—into ICT and non-ICT contributions—is further blurred by sharp swings in the rate of capital utilisation that are not well captured by the statistics.

Given the pitfalls in interpreting data following the global recession, our detailed economic analysis focuses on the period before the onset of the recession (to 2007). This allows us to achieve our primary goal of quantifying the productivity gains that ICT investments can deliver.



## 1

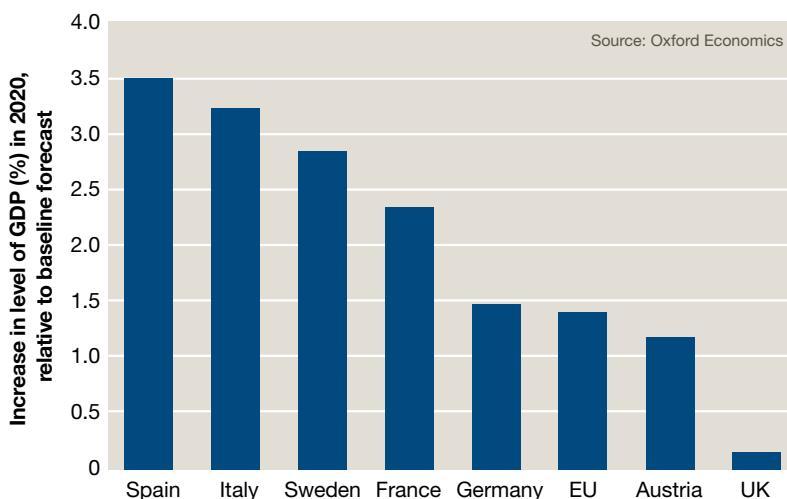
## Capturing Europe's “ICT dividend”

**B**y 2020, if Europe were able to increase its ICT capital stock to the same level (relative to the size of the economy) as that of the US, the result would be impressive: GDP would increase by 5% on average—equivalent to about €760 billion for the EU as a whole<sup>7</sup>, or €1500 per person. For nations experiencing particularly sluggish growth, including Spain and Italy, the impact on GDP would be even greater, to more than 7%.

Of the overall 5% increase in GDP, capital deepening and TFP contribute 3.5 and 1.5 percentage points respectively. It is important to note that the impact on the economy through capital deepening could be achieved with capital investments in other sectors. The TFP gain is an additional return to the economy that is specific to ICT capital investments. To emphasise this, we call the TFP gain the “ICT dividend.”

To benefit from the ICT dividend, Europe needs to bring its ICT capital stock in line with the US and learn from ICT leaders how to integrate these investments into successful business strategies. Chart 3 shows just how much EU countries stand to gain by 2020 if they do both of these things. The chart shows the impact on GDP through TFP, if each country were to bring its ICT capital stock to 30% of GDP (the current level in the US).

**Chart 3: The ICT dividend**



Countries where the stock of ICT is low as a proportion of GDP have the most to gain; in Italy and Spain, the stock, measured as a proportion of GDP, is roughly half that of the US. As for the return on these investments, the dividend assumes that the high returns achieved by industries in countries such as Germany and the UK can be matched elsewhere in Europe. Our modelling indicates that for Spain and Italy these gains will be over €100 billion each in 2020 at today's prices.

<sup>7</sup> EU as a whole refers to the EU 27.

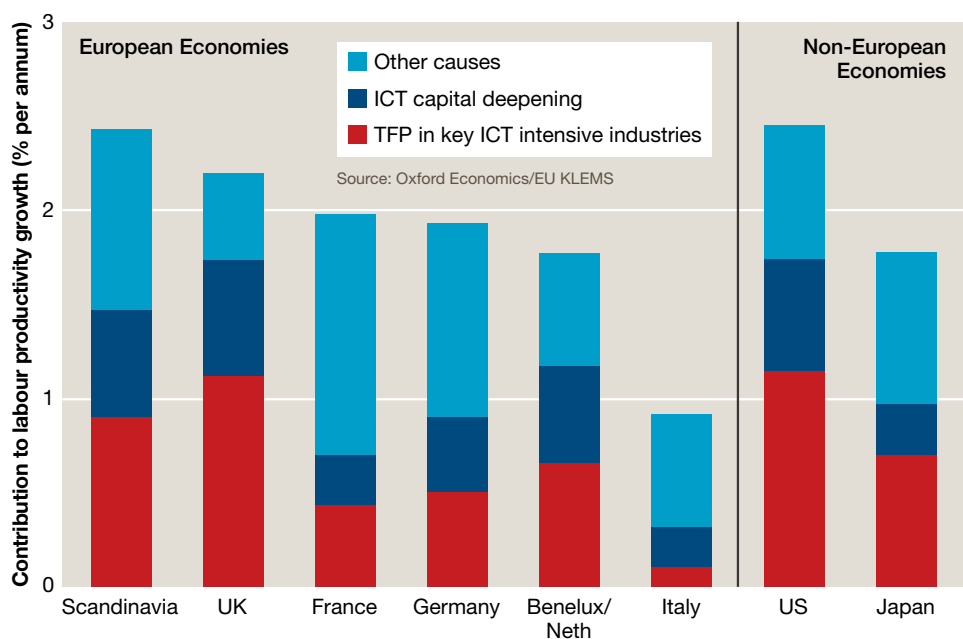
### Understanding the role of the ICT dividend in productivity growth

To understand the ICT dividend, it is important to explain the contribution ICT has historically made to labour productivity growth. Chart 4 compares the annual growth rate in labour productivity for a number of European countries and regions with that of the US and Japan. Each column is divided to show the contribution to growth in labour productivity that came from:

- TFP in “key” ICT-intensive industries<sup>8</sup>
- ICT investment (“capital deepening”)
- Non-ICT factors

ICT through capital deepening and its TFP contribution account for more than 70% of US labour productivity growth, or 1.75 percentage points (pp). As illustrated in Chart 4, ICT’s impact on labour productivity in the US exceeds total labour productivity growth in Benelux/Netherlands and Italy, and almost matches it in Japan. Only the UK and, to a lesser degree, Scandinavia come close to matching the US in the impact ICT has had on labour productivity (1.74 pp and 1.47 pp, respectively). Countries such as Italy and France, where ICT contributes less than 0.5% to productivity growth, are left well behind (although in France other factors have helped bolster productivity growth).

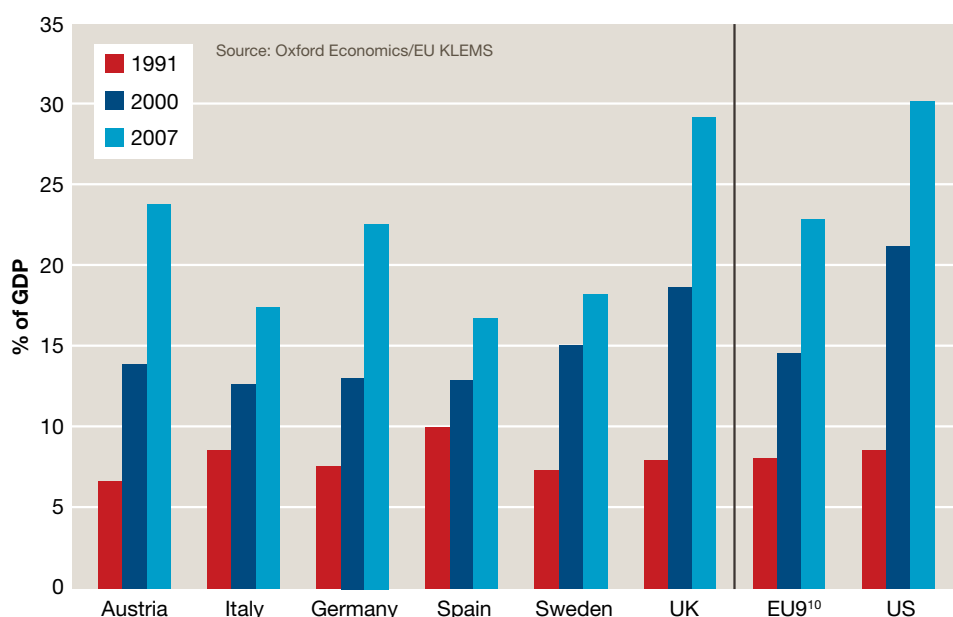
**Chart 4: The impact of ICT on labour productivity<sup>9</sup>**



An important reason why ICT’s impact varies so much from one country to the next can be explained in part by how much each economy has invested in ICT. In the early 1990s, the US and Europe had similar levels of ICT investment. As Chart 5 shows, the US pulled ahead of Europe during the 1990s, and by 2007 its ICT capital stock was worth about 30% of US GDP. In comparison, many European economies’ ICT capital stocks in 2007 were closer to 20% — the US level in 2000.

<sup>8</sup> Industries identified in previous academic research as having invested heavily in ICT and that subsequently experienced a TFP productivity resurgence. This taxonomy is based on US experience but has also featured prominently in research on Europe: the premise being to benchmark Europe’s performance against the US leaders. Chart 6 follows this approach.

<sup>9</sup> Sources of average annual labour productivity growth between 2000 and 2007.

**Chart 5: The ICT capital stock (% GDP)**

***“ICT investment by itself doesn’t have nearly the impact it would when combined with a set of organisational and human capital investments.”***

*Erik Brynjolfsson, the Schussel Family professor of management at the MIT Sloan School of Management and director of the MIT Center for Digital Business*

### The importance of intangible capital

Yet while the scale of investment is important, it is not the whole story. The return on these investments also matters, and some economies and companies have been more successful in generating high returns than others. For example, results from a 2007 study of multinational businesses operating in the UK between 1985 and 2003<sup>11</sup> suggest that US-owned firms’ ICT efforts result in greater productivity than non-US owned firms. The authors of the study also observed that firms acquired by US multinationals increase the productivity of their ICT, whereas identical firms taken over by non-US multinationals do not. One explanation for these patterns is that US firms are organised in a way that allows them to use new technologies more efficiently. Meanwhile, data from a separate study that looked at 1,700 Italian manufacturing firms in 2004<sup>12</sup> suggest that the firms receiving the lowest returns on their ICT investments did not complement those investments with an increase in human capital or a reorganisation of the workplace—crucial inputs into ICT-related intangible capital.

When firms deploy general purpose technologies (GPTs)—technologies that have the capability to dramatically improve business operations, such as the Internet—they must also consider how those investments will be leveraged by their workforce. As Mr. Brynjolfsson notes, “ICT investment by itself doesn’t have nearly the impact it would when combined with a set of organisational and human capital investments.”

These findings are borne out by our research, which uses detailed industry-level data for individual European economies to examine sources of ICT-driven productivity gains. The data set, developed through the cooperation of statistical agencies and research bodies across Europe with funding from the European Commission, is called the “KLEMS Growth and Productivity Accounts.”<sup>13</sup>

<sup>10</sup> Austria, Denmark, Finland, Germany, Italy, Netherlands, Spain, Sweden, UK

<sup>11</sup> <http://www.nber.org/papers/w13085>

<sup>12</sup> <http://www.tandfonline.com/doi/abs/10.1080/0003684042000270031>

<sup>13</sup> KLEMS provides an integrated set of economic accounts for the calculation of productivity statistics. It allows average labour productivity to be decomposed into improvement in workforce skills, capital deepening, and total factor productivity (see the glossary for more information about these concepts). KLEMS provides this decomposition at a detailed industry level.

The results give reasons for optimism in the EU. In particular, the research shows that some EU member states are achieving impressive TFP gains from their ICT investment. Moreover, with many industries having already settled on successful business models that allow them to exploit ICT, corporate laggards have the road ahead well signposted. In fact, provided that they are not impeded by unwarranted regulations or shortfalls in suitably skilled workers, Europe's ICT laggards may see the potential returns on their ICT investments much sooner than their US peers. "Through ICT you do see companies developing innovations more quickly and becoming new market leaders in their sectors," says Dr. Reinhilde Veugelers, a senior fellow at Bruegel, a European economic think tank based in Belgium. "In this respect, ICT is definitely a paradigm that allows companies and countries to quickly catch up."

### Seven practices that enhance returns on ICT investment

In 2002, Erik Brynjolfsson and Lorin Hitt undertook a large-scale survey of firms' organisational practices and their link to productivity. They found that seven practices were more common in ICT-intensive firms than their counterparts, and these approaches were positively correlated with higher productivity. Moreover, the companies that simultaneously invested in ICT and in the practices did disproportionately better than firms that only made investments in ICT. The seven practices remain relevant for firms today:

- 1 Move from analog to digital processes.** Moving to a digital environment frees the firm from the physical limitations of paper and supports the other six key practices.
- 2 Free information access and communication.** Encouraging the dispersal of internal and external documents throughout the firm fosters lateral communication among employees and vertical communication between employees and managers.
- 3 Empower employees.** Successful ICT-using firms embrace decentralisation and delegation, pushing decision rights to those with access to information. At the same time, digital processes help enforce rules or constraints by alerting personnel if an exception occurs.
- 4 Use strong performance-linked incentives.** Meritocratic pay structures, incentive-based pay and wider use of stock options for a broader set of workers are common at firms that successfully use ICT.
- 5 Invest in corporate culture.** Promote a cohesive set of high-level goals and norms that pervade the firm. Regularly communicate these strategic goals throughout the organisation with an emphasis on promoting a strong corporate culture.
- 6 Recruit the right people.** Executives in successful ICT-using firms tend to be more involved in the recruitment process, and new employees are more likely to be screened for capabilities across a variety of criteria, such as education, analytical skills, and computer skills.
- 7 Invest in human capital.** Hire highly educated employees and then provide ongoing training (much of which is available online).

## 2

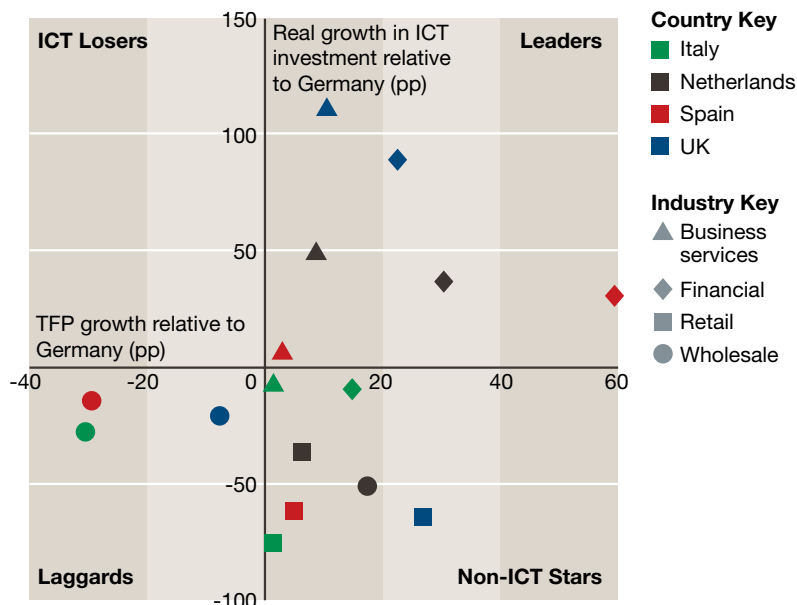
## ICT and corporate productivity

Clearly, as shown in the previous chapter, ICT productivity depends on both tangible and intangible capital. This helps to explain why certain sectors tend to be at the forefront of investment and productivity gains. Industries that depend heavily on information exchange—finance, business services, and the retail and wholesale industries—were early adopters of ICT in the US. These are sectors with a large amount of data processing and for which transactions can be readily standardised. In addition, these sectors typically are service areas where staff can often be easily reorganised and retrained.

*Successful firms transformed their businesses through the application of new technologies.*

Chart 6 shows how much ICT investment and TFP grew between 2000 and 2007 for four industries in the market services sector—finance, business services, retail, and wholesale. Each industry is shown for the UK, Italy, the Netherlands, and Spain, with its performance benchmarked against its German equivalent. For example, over the period, the UK banking sector outperformed the German banking sector in both its investment in ICT—by close to 90pp (percentage points)—and in terms of its TFP growth (22pp). In the chart, Dutch and Spanish banking also appears in the top right quadrant among the ICT leaders.

**Chart 6: Leaders and laggards, 2000-2007\***



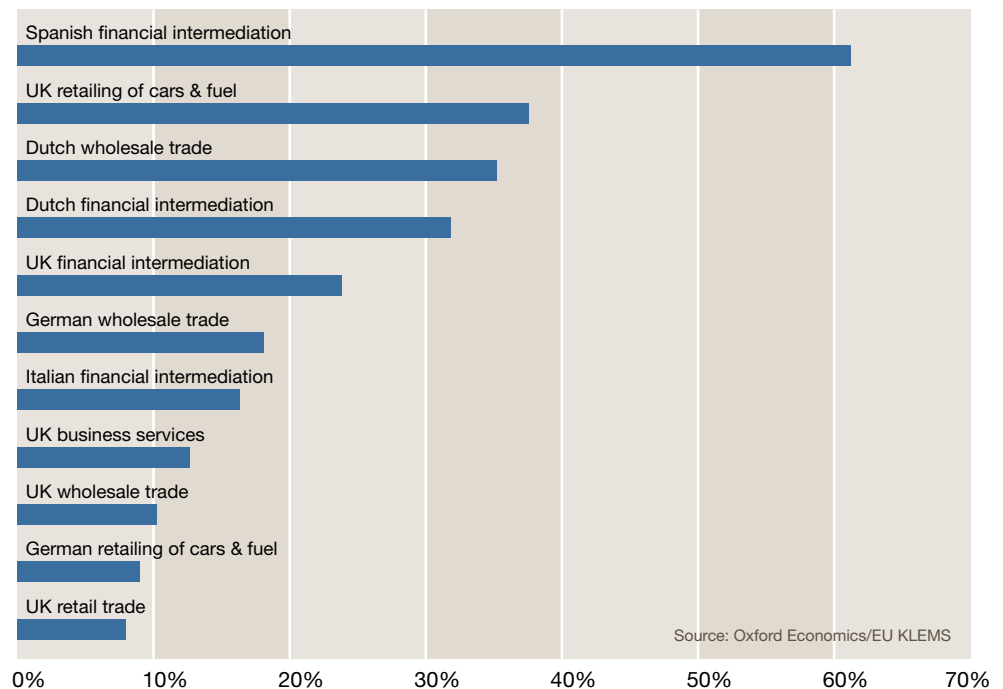
\*Unfortunately, data are not available for France. Source Oxford Economics/EU KLEMS

In contrast, some industry sectors have underinvested in ICT and have fallen behind their German peers in terms of TFP growth. The Italian wholesale sector exemplifies this group, with underinvestment in ICT (-29pp) and weak TFP growth (-31pp), compared with its German peers. Of course, ICT is not the only factor driving productivity in market services, and the industries in the lower right quadrant—“non-ICT stars”—are industries where good TFP performance seems not to be due to their ICT investment.



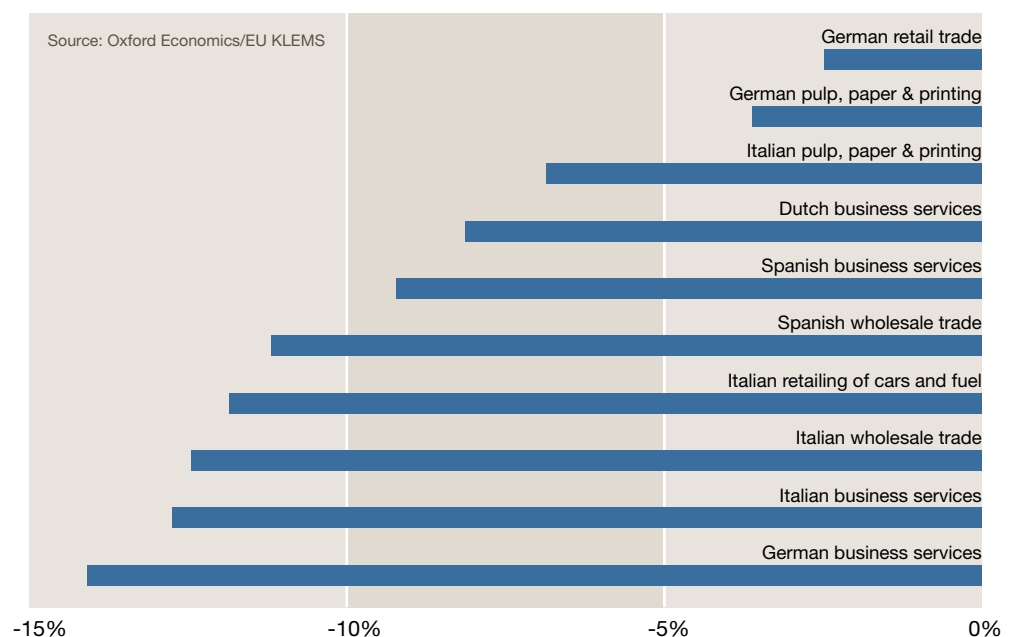
Some industry sectors are more successful at reaping gains from ICT than others. Chart 7 shows industries in five major European countries (Germany, Italy, the Netherlands, Spain, and the UK) that have exhibited the highest TFP growth.

**Chart 7: Key industry sectors with the greatest TFP growth<sup>14,15</sup>**



Conversely, Chart 8 shows those sectors that have not fared as well. This can be due to inherent business practices at the company level as well as broader external factors, such as labour and product market regimes that hamper quick adaptation.

**Chart 8: Key industry sectors with negative TFP growth<sup>14,15</sup>**



14 Analysis considers German, Italian, Dutch, Spanish, and UK ICT-using industries between 2000 and 2007.

15 Key industries are those identified as intensive ICT users by academic research.

## Examples from the business world

There is a clear pattern to the way firms generally view ICT investments, according to John Higgins, director general of Intellect, a UK ICT trade association. Productivity improvements usually begin with a desire to reduce costs, through centralising and automating operations such as payroll, resource planning, invoicing, and customer management. Then, companies use ICT to look for a myriad of incremental improvements to do more with less by gaining additional market share. This can mean gaining access to new customers or expanding their network of suppliers. Finally, companies look for ICT investment to open up a whole new business area, the most dramatic recent example of which is the evolution of the digital marketplace. Providing access to new markets has the greatest absolute impact on productivity and global competitiveness.

Many firms have taken the bold decision to make IT investments during the downturn with the long-term goal of managing costs. “We conducted a study in 2008, and it showed us that we needed to change our approach to spending on IT,” says Michael Barnett, who heads strategy execution at **British American Tobacco (BAT)**. “So in the midst of the recession, we realised that we needed to increase our investment in IT by entering into a large-scale ERP implementation to support a standard operating model across the enterprise.” This will help streamline processes across the company’s global offices, allowing some functions to become shared service centres.

Mr. Barnett says the company realised early on that success would depend on more than just installing a new system. Equally important, he says, are “explaining to senior managers and the people who operate the systems what the benefits are, what’s in it for them, and gearing everything up ahead of time.” To that end, an important part of the readiness stage is capturing best practices and lessons learned, “so we can make the deployment process smoother and more efficient each time we implement in the next market.”

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*“People are now consciously and proactively looking for what technology can do for us to make our jobs easier.”*

*Andy Stevens, CEO, Cobham*

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The aggregate data suggests that the service industries are the biggest beneficiaries of ICT-related productivity gains, but there is plenty of anecdotal evidence from companies that all kinds of industries—including traditional engineering-based and manufacturing sectors—see gains from ICT investment in productivity and profitability. **Cobham**, a multinational aerospace engineering company (which also has pursued a strategy of acquisition), has a “change program” that relies heavily on ICT investment and has demanding targets in terms of its expected return on investment (ROI). The company has invested £130 million over three years and believes, as Cobham CEO Andy Stevens says, that ICT is ‘a critical enabler.’ The company is spending just over 5% of its sales revenue on the next generation of technology, and “we’re trying desperately, even in these difficult times, to increase that to 6%.”

For a company like Cobham, which has acquired 54 companies in the past decade, the process of integrating its acquisitions speedily and finding synergies is integral to its overall value, and having standard systems is critical, Mr. Stevens says. In fact, Stevens says the company has entered into a virtuous circle with ICT. Over the last decade, “ICT has transformed our business,” Mr. Stevens says. The process of standardising systems across the businesses—and the rewards that have come from that—has meant that “people are now consciously and proactively looking for what technology can do for us to make our jobs easier and better.”

For other firms, ICT investments critically support market share gains. At **Saxo Bank**, the Copenhagen-based international investment bank, ICT not only drives productivity but also overall revenue growth. The bank, which operates exclusively online, employs more IT specialists than any other type of employee, and all of its systems—telecommunications, customer management, risk management, and so on—are interlinked. Marketing is a large expense, and there is considerable focus on lowering the cost of acquiring new customers and maximising revenue and profit per customer. “In terms of productivity, we are always looking at ways we can get a higher return for the same expenditure,” says Albert Maasland, chairman of Saxo Bank’s UK operations. “We are using ICT basically to reduce the number of people we need to provide client service.”

As a virtual bank, Saxo’s management team strives to continually improve its cost of client acquisition (through advertising and other marketing), reducing the expense of servicing clients, managing risk, and enhancing the product offering to clients. Apart from marketing, management’s main concern is compliance with regulations in the many countries in which it operates, as well as cybersecurity.

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*Barclays is investing substantially in ICT hardware and software as well as intangible capital in order to boost profitability per employee.*

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At **Barclays Wealth**, the multinational fund management and advisory group, ICT underpins strategic business growth. According to Ian Henderson, chief operating officer at the Barclays division, the unit has grown over the past few years mostly through organic growth but also through selective acquisitions, including part of Lehman Brothers, which broke up during the financial crisis in 2008, as well as firms in Asia, the Middle East, and South Africa. Typical of a large multinational, Barclays decided to rationalise parts of the operation while preparing it to attack new markets through a change management program. This entails an ICT-heavy slate of investment over three years, with the bank earmarking £350 million for the project even during an economic downturn.

Barclays’ move is “on one hand a brave decision, but one where there is a significant P&L upside forecast on the back of the investment,” Henderson explains. A large plank of the program is a system that allows Barclays’ growing ranks of bankers to manage their customers more efficiently, which in turn reduces costs and increases transactions. Henderson estimates that cost-cutting is driving about 30% of the program’s rationale, while additional revenue generation accounts for the other 70%. The company is investing substantially in ICT hardware and software as well as in intangible capital—including a large-scale training program that will help the firm service clients at the same standard around the clock—in order to boost profitability per employee.

## Barclays builds its future

### *ICT helps improve profitability and productivity even in a downturn.*

Barclays has a long history of mergers since its founding in 1736. By 2009, Barclays Wealth was a vast mix of global businesses in need of reorganising. “The board agreed that we needed to rationalise the businesses,” says Ian Henderson, the firm’s COO. That led to a change management program called Project Gamma, an effort that will cost \$572 million (£350 million) through early 2013. A primary goal of Project Gamma is to make the firm’s wealth management arm a substantial contributor to Barclays group profits.

Project Gamma supports leading-edge wealth management with five building blocks, Henderson says. The first is new customer relationship management (CRM) software that logs, records, loads, and indexes every aspect of client engagement. It also manages the new business pipeline by reporting whether prospects are hot or cold, their potential for generating revenue, and their proximity to closing deals. The second building block promotes an investment philosophy attuned to behavioural finance, a Nobel Prize–winning concept in economics that probes and explains risk aversion and its consequences. The third building block, a “portfolio constructor,” designs investment portfolios with suitable levels of risk based on behavioural finance and an extensive questionnaire that clients complete.

Because in a typical month a Barclays client receives 20 communications (either in print or electronically), the fourth building block is a system that governs client communications. Its goals are threefold: improve clients’ experience, boost productivity, and trim costs. A new generation of bankers’ workstations, the final building block, supplies a capstone: Sleek interactive tools enable bankers to view and mobilise everything that Barclays has learned about the risk profiles of current and prospective customers, and anything else pertinent to investment decisions. Screens permit bankers to work with more than one prospect at a time, if necessary, and automatically update profiles when calls end.

## Jaguar Land Rover's Competitive Approach

***Cutting-edge tools cut costs and help the firm expand into new markets.***

Building a car isn't easy—especially when meeting the standards of a firm with a reputation for design, quality and luxury. At Jaguar Land Rover, the development of a new vehicle requires the integration of roughly 2,500 parts, according to Dr. Al Saje, the automaker's manager of future business, and market and competitor intelligence. “Those parts are not just procured and then screwed or bolted together; they are designed to perform together as a vehicle with numerous targeted characteristics.” As a result, the firm makes a heavy investment in computer-assisted drawing (CAD) and computer-assisted engineering (CAE) tools, which allows engineers to simulate combustion inside a specific engine, the stresses in a pressed panel or how a chassis responds to certain road conditions. “We are highly dependent on ICT throughout the process,” he says.

One of the real issues the automaker had to address, says Dr. Saje, was the length of time it took to develop prototypes for new vehicles, a time-consuming process losing valuable speed to market. “The time it would take to move from the first concept to getting the new model ready for manufacture could take as long as five years,” he says.

Thanks to its investment in ICT, that time has not only shortened, but production quality has improved. Today, for every auto part “drawings and specifications are developed and communicated digitally, across geographically extended teams and through the process chain from component designers through to purchasing manufacturing, logistics and servicing.” Dr. Saje says the effort was critical to the firm's long-term strategy: “I can't imagine how we could make cars of the quality that we do and at the speed that we do, and with the complexity that we build them at, without having our systems now. Without it, we would not have been able to compete.”

To further speed the development of new auto models, the company is turning to cloud computing and mobile devices. “We are starting to allow people to work more distantly from the center, but to stay connected and closely engaged. For example, our entire executive committee is connected through systems they carry around with them on their iPhones or iPads.” That agility is critical as the firm moves into new markets. “It's a time of great volatility but also growth,” Dr. Saje says. To meet the opportunities in places like China and India—and deal with the increased risks inherent in the ‘new normal’ economy—the automaker has put in place a set of trigger mechanisms. “That way, if some of these investments don't come off, or if things change, we can change plans very quickly as well,” he says.



## Recommendations for corporations

Our interviews with leading firms shed light on best practices for companies that recognise the need for greater investment in ICT. The following are specific action points that the data and evidence suggest companies consider:

- **Don't wait for the economy to improve to invest in ICT.** Getting buy-in for new initiatives is always difficult, particularly in times of sluggish growth and tight budgets. ICT spending is often first to be cut when budgets tighten, a move that can be short-sighted, says Dr. Veugelers of Bruegel. “Companies should really see ICT investment as being part of their overall growth strategy,” she says. “If they don't, it will be much harder to attain any kind of long-term productivity improvements.”
- **Explore how enterprise applications can help your business.** Many executives admit that their firms do not have the fully functioning systems needed to maximise ICT productivity. These critical systems include enterprise resource planning (ERP), supply-chain management (SCM), and customer relationship management (CRM) systems. These software suites can go a long way toward improving productivity and streamlining processes to eliminate redundancies.
- **Don't neglect intangible capital.** Companies that install new systems but do not take the time to properly train employees or consider how new tools will affect processes will find their efforts largely wasted. Executives should not only consider this when considering new investments and calculating ROI—they should also think about how existing systems might bring greater value as a result of investments in intangible capital.
- **Roll out new systems in phases.** In today's volatile marketplace, companies need to be able to scale up and down as business needs shift. “Big bangs never work very well,” says Steve Weston, group technology director at Hays PLC, a leading global recruitment firm. To do this successfully, however, requires “a clear board mandate and board governance, and clarity of support from the top of the organisation,” he says.
- **Constantly measure results.** At Jaguar Land Rover, executives are alerted early on if initiatives are going off track or if investments don't seem to be paying off. That early warning system allows the firm to shift plans and course-correct before a small problem becomes a crisis.

## 3

## The impact of government policy on ICT

*“If we don’t seize the opportunities of the Digital Agenda, if we don’t get it right, then come 2020 our lives will be the worse for it.”*

*Neelie Kroes, vice president, the European Commission*

The European Union and its member states have recognised for some time the central role that ICT plays in economic growth, especially in creating future jobs. The European Commission has underlined the importance it attaches to ICT by defining a new portfolio called the “Digital Agenda” and assigning responsibility for it to one of its most senior members, Vice President Neelie Kroes.

“Europe is in a difficult corner right now,” said Ms. Kroes in her “State of the Digital Agenda” speech in June 2011. She outlined how the Commission’s “Europe 2020” strategy for economic growth seeks “to save us from a lost decade of sluggish growth, and to give us jobs which are smart, green, and inclusive: an economy that promotes innovation, and provides jobs fit for the next generation.” ICT is the instrument to achieve this, she continued: “We cannot promise everyone a job tomorrow. But if we don’t seize the opportunities of the Digital Agenda, if we don’t get it right, then come 2020 our lives will be the worse for it.”

But how effective is government policy on ICT investment to improve productivity? To measure policy effectiveness, we have aggregated some of the World Economic Forum’s (WEF) measures of the success of individual elements of government policy on ICT into an overall effectiveness score. The data is largely based on a survey of business executives. Their opinions of the environment in which their firms operate are important, since they routinely make decisions about where investments should be made. These decisions naturally have consequences for employment, income growth, and tax revenues across countries.

The composite government ranking on ICT policy comprises five elements:<sup>16</sup>

- 1 A ranking of each country’s laws relating to the use of ICT.
- 2 A ranking of the priority the government in each country places on ICT.
- 3 A ranking of the extent to which each government has a clear implementation plan for utilising ICT to improve their country’s competitiveness.
- 4 A ranking of the extent to which each government’s use of ICT has improved the efficiency of government services.
- 5 An index that assesses the quality of government websites for providing online information to the people, as well as participatory tools and services (e-participation).

<sup>16</sup> Data are drawn from the World Economic Forum (2011), “The Global Information Technology Report 2010-11, Transformation 2.0.”

Under the results of the ranking system, illustrated in Table 1, the higher the number, the more effective the government's ICT policy (with 7 being the highest). The highest-ranking countries are Singapore (5.89), South Korea (5.67), and Australia (5.41). Within Europe, the countries judged to have the most effective government ICT policy are Sweden (5.35), Denmark (5.19), and the UK (5.06). Greece (3.37) and Italy (3.40) rank lowest for Europe.

**Table 1: Top 10 government ICT policy effectiveness composite ranking**

Rank	Country	Laws relating to ICT	Govt prioritisation of ICT	Importance of ICT to govts vision	ICT use & govt efficiency	Index of e-participation*	Composite govt ICT policy ranking
1	Singapore	5.91	6.38	6.16	6.15	4.83	5.89
2	S. Korea	5.10	5.56	4.95	5.73	7.00	5.67
3	Australia	5.48	5.28	4.98	4.95	6.37	5.41
4	Sweden	5.91	6.07	5.36	5.99	3.43	5.35
5	USA	5.39	5.54	4.79	5.08	5.32	5.22
6	Malaysia	5.08	5.76	5.13	5.37	4.62	5.19
7	Canada	5.49	5.35	4.71	5.28	5.11	5.19
8	Denmark	5.69	5.49	5.01	5.18	4.48	5.17
9	UK	5.37	5.34	4.51	4.69	5.39	5.06
10	Finland	5.53	6.09	4.91	5.28	2.87	4.94

\* E-Participation index measures the quality, relevance, usefulness and willingness of government websites for providing online information and participatory tools and services.

Source: Oxford Economics & World Economic Forum (2011)

The average ranking for the EU15 countries' government policies on ICT is 4.63 (out of 7), well behind the three leaders and the US, and outside the top 10. While the average masks considerable diversity (for example, Sweden ranks fourth in the world at 5.35), this suggests European governments policies on ICT have room to improve their effectiveness.

To translate these effectiveness scores into their impact on productivity, we have correlated them against the productivity data for 42 countries, demonstrated in Chart 9.

**Chart 9: Government policy composite ranking of ICT and annual productivity**  
Each red dot represents the results for an individual country.



The chart shows there is a positive correlation: countries with effective ICT government policies tend to have high productivity. Similarly, countries with ineffective ICT policies tend to have low productivity. This is confirmed by the positive slope of the best-fit regression line.

The enhancement of government ICT policies, alongside greater investment in ICT and related intangible assets, should help Europe realise productivity gains.

## The EU Digital Agenda

With the encouragement of many in the industry, and with a strong commitment from Ms. Kroes, the European Commission launched its Digital Agenda initiative in May 2010. This is an ambitious program to identify the key policy areas needing legislative and other government action in order to help make Europe internationally competitive, in particular by creating a level and transparent market and fostering the conditions for ICT investment. The Commission's efforts focus on seven areas:

- 1 A digital single market.** More than 20 actions are underway, including simplifying rules for the licensing and distribution of online content, rationalising value added tax (VAT) for online sales, and harmonising data protection rules.
- 2 Interoperability and standards.** To harmonise technical standards across the EU.
- 3 Trust and security.** More than a dozen actions are underway to improve and standardise cybersecurity.
- 4 Very fast Internet.** Targeting download rates of 30 megabits per second for all of its EU citizens, with at least 50% of European households subscribing to Internet connections above 100 megabits per second, by 2020.
- 5 Research and innovation.** To rationalise public initiatives and help spur private spending on R&D, and to look for ways to help turn ideas into marketable products.
- 6 Enhancing skills.** To broaden digital literacy and address industry skills needs.
- 7 ICT and social policy.** Maximise ICT's potential in areas including energy efficiency, health-care policies, and efficient government.

The European Union also has been pursuing a complementary agenda for international trade in ICT. In early 2011, the EU and the US agreed on a set of trade principles they intend to promote with other countries. These address transparency in legislation and regulation, including open access to networks and applications, the free flow of data across borders, foreign investment in ICT sectors, the cross-border supply of services, the efficiency of spectrum allocation, the independence of regulatory authorities, the granting of operating licenses, and the interconnection between suppliers of basic public telecommunication services.

## Keeping up with change

It is no coincidence that the Commission's efforts on the Digital Agenda have come at a time of rapid technological change and advancement, facilitated by the growth of internet infrastructure. The growth of new technologies such as cloud computing, machine-to-machine (M2M) technologies, and other tools have the potential to help businesses lower costs, increase efficiencies, and enhance productivity.

However, legislators are struggling to keep up with the pace of change, and the development and use of these fast-moving technologies has forced policy-makers to take a fresh look at the legislative and regulatory environment in the EU. The Commission's focus, as is often the case, is on European internal harmonisation (single market) and making the Union a more effective place to do business.

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*The growth of cloud computing has been singled out as a particular issue because of the challenge it presents with regard to data protection rules.*

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The growth of cloud computing has been singled out as a particular issue, for example, because of the challenge it presents with regard to data protection rules (given the difficulty in determining the location of data and the equipment handling it at any given time). There also are questions of competition and how consumers will be able to move from one supplier to another without losing access to important personal data.

In November 2010, the Commission announced plans to reform the EU Data Protection Directive, which regulates the processing of personal data within the EU. This is an attempt to modernise the legal framework to take the digital age into account and protect individuals' data across all policy areas. It is also an opportunity to further streamline the application of data protection rules across various jurisdictions throughout the EU. Indeed, a stated priority for the Commission is to cut through red tape and ensure a level playing field throughout via the uniform application of data protection rules.

The increasing adoption of cloud computing also creates a pressing priority to reform rules around international transfers of data. Large multinational firms often must transfer data between regions, and currently they follow a system of Binding Corporate Rules (BCRs) that allow firms to do so in compliance with EU Data Protection Law. However, the BCR process is expensive, suffers from delays, and puts enormous resource pressure on countries' individual Data Protection Authorities (DPAs). The Commission is now reviewing the BCR process as well as alternatives to replace it. One option is to create legally binding commitments and codes whereby corporations are responsible for ensuring data protection wherever the data is stored. It remains to be seen which approach the Commission will eventually adopt.

Keeping regulations up to date with the latest technologies is challenging in other areas. Innovations in M2M technology, for instance, have led the Commission to review regulations covering the radio spectrum four times since 2006. Ensuring guaranteed access to the radio spectrum across international markets, which is critical for many M2M applications, will remain a focus of the Commission's work.

Finally, while ensuring that there is a properly regulated market, the Commission also must balance the needs of industry. New technology providers and business communications service providers (which provide European businesses with internet-based solutions that improve their productivity and efficiency) face obstacles from some of the administrative barriers that still exist within the Union.



## National Digital Agendas

The EU's Digital Agenda is underpinned by national digital agendas that have been in place for several years. As with other EU single market initiatives, the aim is to help all ICT industry participants achieve the benefit of scale to compete in world markets, while also fostering innovation at the grassroots level and encouraging investment. In all cases, national governments have explicitly recognised the importance of the digital economy and its central role in future growth and job creation. All are working on policy frameworks that will provide the regulatory environment, national infrastructure and human capital skills needed to help ICT deliver productivity growth.

Existing national digital agendas have aims that are broadly similar to the EU's Digital Agenda, though the specific targets vary. In **Germany**, for example, the government has a “four pillar” strategy for broadband, the goals of which include having 75% of households with access speeds of at least 50 megabits per second by 2014. The German government's role is pivotal. The first pillar in the German strategy is coordinating infrastructure projects so that the billions of euros in costs required to extend and upgrade the broadband network can be defrayed by fostering cooperation between various infrastructure providers (energy utilities, for example) and by allowing third parties access. This requires a direct coordination initiative by federal and local government authorities.

Among the proposals to foster infrastructure growth are tax concessions for any company connecting broadband to buildings or distributing it within apartments. Other pillars include promoting mobile frequency policies that extend broadband access, using government subsidy programs (some already existing, such as regional funds) to extend broadband to non-metropolitan areas (40% of existing or potential broadband users), and ensuring that regulatory frameworks on issues such as planning and access promote efficient investment.

In **France**, the Digital Plan, launched in 2008, contains a host of proposals for achieving ICT aims (which included universal broadband access by 2010) by encouraging domestic and foreign companies (as long as they have French subsidiaries) to invest in or link with institutions of higher learning. Among the initiatives are fostering public-private partnerships, financial aid for small start-up companies needing to acquire ICT equipment and access, promoting telecommuting, and a range of initiatives to digitise government departments and rationalise rules and regulations.

Similarly, the **UK's** Digital Britain strategy, finalised in 2009, sets out an agenda that includes five objectives: upgrading wired, wireless, and broadcasting infrastructure; promoting investment and innovation; fostering public service content, especially in the news; developing digital skills at all levels; and securing universal broadband access, particularly to deliver public services more effectively.

Finally, **Sweden's** objective for broadband is to provide 90% of households and businesses with access speeds of at least 100 megabits per second by 2020. Other initiatives include a new model for spectrum management, fostering investment for rural area coverage, and new guidelines for local authorities on electronic communications in planning applications.

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*France's Digital Plan contains a host of proposals for achieving ICT aims by encouraging domestic and foreign companies to invest in or link with institutions of higher learning.*

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The “Digital Agenda for Europe” paper contains targets for a number of key performance indicators for member states, and progress reports are published at regular intervals. One of the targets is basic broadband for all European citizens by 2013. At the end of 2009, Digital Subscriber Line coverage had reached 94% of the population, up from 92.7% a year earlier, according to the report.

Our data show that whilst these national plans are clearly well thought through, there is significant scope for improvement in implementation and effectiveness, for European economies to grow faster and be more globally competitive.

### Viewpoint: Robert Madelin

*Robert Madelin has been director-general of the European Commission's Information Society and Media Directorate-General since April 2010 and a senior official at the Commission since 1993. Here, he discusses Europe's Digital Agenda 2020 and specific actions to achieve its objectives.*

#### **For Europe's Digital Agenda 2020, what are the key milestones, and how will you measure progress toward the program's goals?**

Mr. Madelin: Starting with broadband, we reckon we're pretty well on track by 2013 to get basic broadband available for everybody. There are some problems in more remote areas in some countries, and maybe other technologies—mobile or satellite, for example—can help fix that. Some of that will require public money and some won't. In the denser, richer areas where the infrastructure is being rolled out we're not going to do anything in terms of public spending. At the other extreme, the rural economic support measures and the structural fund continue to be applicable. In between, we are proposing legislation to create a Connecting Europe fund, of which one pillar will be innovative financial instruments to help the markets spread the risk at the grey area between what can only be done by public intervention and what is going to be funded out of the market. We are planning to put €10 billion into that over the budgetary period, which begins in 2014.

#### **Estimates of the investment needed for broadband infrastructure are of the order of €250 billion through 2020. What can be done at a European and national level to encourage private-sector commitment for that?**

On the local level, there is synergy between the broadband issue and some of the other aspects of the Digital Agenda. I would pick two: one is in public services, the other is the Digital Single Market. If the Digital Single Market gets more support, that will create more small-business need and more consumer interest in using broadband. The revenue prospects for any given broadband investment will then improve. On that front, the good news is that the summer European Council focused very much on the Digital Single Market<sup>17</sup>. On public services, the Polish presidency of the EU is putting a big emphasis on e-government. If you can do everything online it is a huge driver for municipal and regional investment in high-speed broadband.

17 At the June European Council summit of EU political leaders, it was agreed that the Commission would prepare a road map for completion of the Digital Single Market by 2015 and report on this road map in October 2011.

**Europe has been ahead of the US in the past with regard to telecommunications, partly because it effectively managed spectrum. Where does it stand for the next generations in the Digital Agenda?**

Europe needs to work more closely together on spectrum. The current debate in the Council and Parliament on the radio spectrum policy programs (RSPP) approach is a step in the right direction. Everybody has problems with the legacy on spectrum, but in Europe I think at least the need to work together has been clearly identified. I am optimistic that the RSPP discussions now underway will produce new momentum in the right direction.

**What are the most important actions in terms of the labour market for ICT?**

Developing skills for ICT—both in school and the workplace—is crucial. It is very much a local and sectoral issue where companies have a strong role to play. Education has a strong role, and there the EU nations cooperate very tentatively, though it is getting better. Another issue is around diversity; ICT is perhaps a more diverse sector than others in terms of race, colour, creed, and sexual orientation. But in terms of gender it's less diverse than the average workforce.

**Is there broad agreement about the steps that need to be taken on e-procurement by governments to foster growth in small- and medium-size enterprises (SMEs)?**

If e-procurement becomes the norm, then life gets easier for SMEs—that's clear. If our current large-scale pilot projects were to become the norm across governments and across the 27 member states, we would be on a fast track to extending the use of online procurement for the totality of public-sector spending at all levels. The major obstacle to that is the creation of a stable financing model for an EU-wide e-procurement network, which is part of the Connecting Europe plan we were talking about. So, there will be two important goals to be achieved in the next six to 12 months: One, which is coming up at the Polish presidency ministerial conference on e-government in October, is to gain commitment from the member states. The second is the establishment of legislation that can finance the hub-and-spoke system to put e-procurement in place.

**What are the priorities in terms of encouraging investment in R&D and start-ups?**

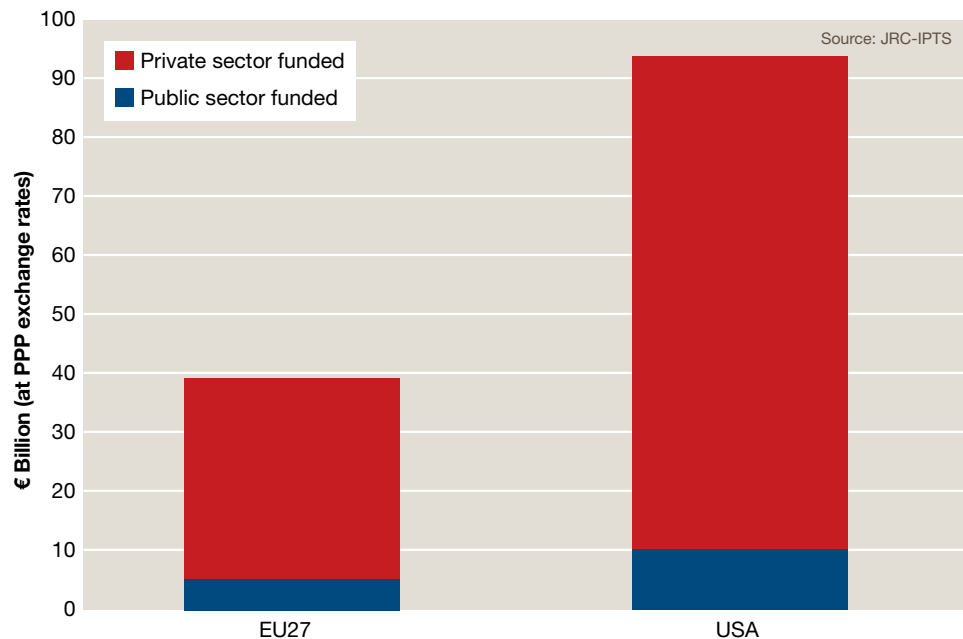
Making Europe a happy place for entrepreneurs is an important part of the debate. The administration is working with business executives and venture capitalists to better integrate the European capital managers with the sector. Matchmaking and relationship building are going to help that. The second level involves European patent reform and maybe even a more favourable tax regime for exit strategies and IPOs. In terms of different member states, there are some experiments including linking patents to tax breaks and so on. I think the current climate, which is a difficult one, is actually making it possible for people to talk about tax issues more than they did a few years back.

### Fostering investment in R&D

The need for government action to foster additional ICT investment is clear. That investment should also be underpinned by investment in R&D to develop services and next-generation products that will capitalise on the ICT capital stock in the future.

Not only is overall ICT investment lower in Europe than in the US, European investment in R&D in ICT was also well behind that of the US in the period up to the financial crash in 2008 (Chart 10).

**Chart 10: Spending on ICT-related R&D in the EU-27 and USA in 2007**



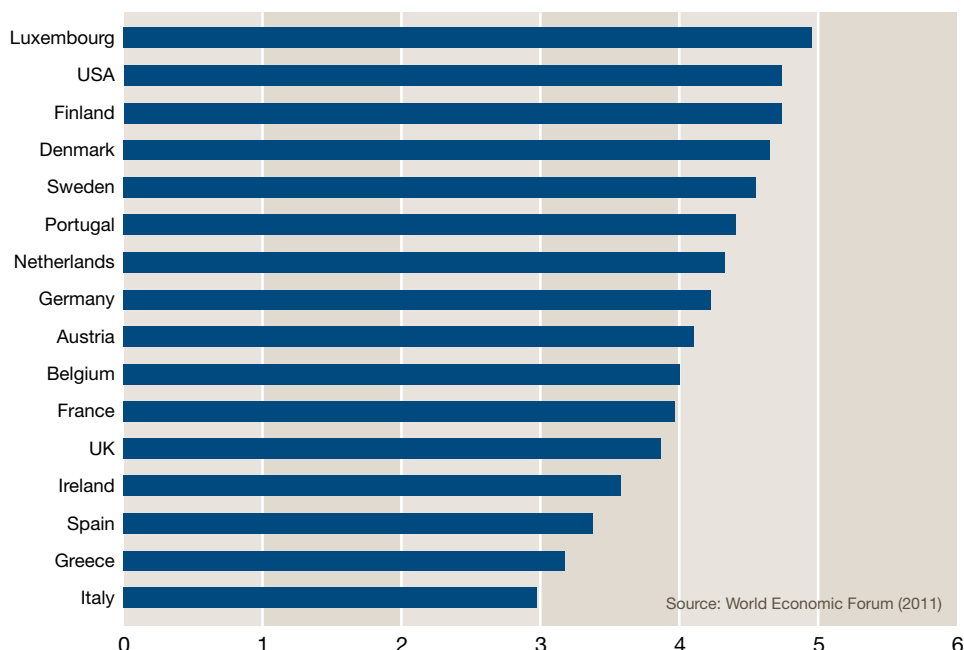
In setting out the Digital Agenda in 2010, the Commission explained that Europe's lower ICT R&D spending was due to three main problems:

- 1 Public-sector funding of ICT-related R&D is low relative to the US in outright terms (€5.3 billion compared with €10.4 billion), and European spending is widely dispersed. The Commission argued that member states should double ICT R&D investment to €11 billion by 2020 and coordinate it across the EU.
- 2 Private-sector investment in R&D in ICT is also fragmented, restricting the scale and availability of funding to research teams located in different parts of Europe. The problem is particularly acute for SMEs.
- 3 Europe is slow to turn ICT into useful innovations, notably in areas of public interest. The Commission has proposed making better use of public procurement of advanced ICT-using products to promote ICT-based growth.

On the latter point, the Commission noted that governments are a major purchaser of ICT in the EU, accounting for a fifth of ICT market by value. However, not all national governments appear to be making best use of their market position, especially the larger European economies. Chart 11 shows how businesses view the impact of government procurement on innovation in each country.

**Chart 11: Do government procurement decisions foster technology innovation in your country?<sup>1</sup>**

1 = No, not at all, and 7 = Yes, extremely effectively.



The USA is the leading large economy from this data, but it is interesting that Germany, France, the UK, Spain and Italy all underperform smaller European economies in using their buying power to foster innovation.

The Commission recognises that member states could use their purchasing power more effectively to promote ICT R&D, adoption, and innovation. As part of its Digital Agenda, it is challenging the EU to make more strategic use of pre-commercial procurement (in which it agrees to acquire and purchase goods and services that have not yet been fully commercialised). It believes this will help leverage more private-sector investment.

## Policy conclusions

Over the last decade, much progress has been made by national governments, with encouragement from the EU Commission, toward various initiatives aimed at improving economic productivity and competitiveness through ICT.

The EU's Digital Agenda is a clear sign of how seriously European policy-makers take the issue. But the Digital Agenda, in itself, is not a silver bullet; the data show that more work needs to be done to foster conditions for ICT investment that will make Europe more productive and internationally competitive. The evidence we have studied suggests the following would help:

- **Member states must recognise that ICT, if used well, can be a powerful driver of productivity improvement in an economy.** European governments should put ICT policy at the heart of their economic reform and growth plans. This means not only creating the right conditions for ICT investment—including an effective, low-cost communications infrastructure, a skilled workforce, and a school curriculum designed in partnership with the ICT industry—but also becoming early adopters of new technology.



- **As our analysis has shown, government procurement has a key role to play in fostering innovation in ICT.** Europe could make greater use of pre-commercial procurement, in which governments and EU institutions purchase ICT goods and services that are still in the early stages of development. This acts as a boost to the technology, gives the public sector a head start, and can increase productivity. However, large-scale government procurement in some countries has been beset by problems in the past (delays, unclear specifications, and cost overruns being the primary culprits). Governments should make more use of the project management skills found within their supply side or contractor teams to train officials so they have the expertise needed to avoid such failures. This entails greater cooperation between the public and private sectors.
- **Harmonising data protection laws across the EU will increase legal certainty for companies looking to invest in European markets.** The patchwork nature of national rules on data privacy and security can discourage companies from making necessary ICT investments, particularly for cross-border services. The Commission is revising the EU Data Protection Directive, and should prioritise and accelerate this process.
- **The current arrangements that govern data transfer to non-EU countries should be improved.** An accountability-based transfer regime, where duty of care is placed on all those processing European citizens' data, should provide sufficient safeguards and allow cloud computing and other cross-border ICT services to develop more quickly without governments having to redraft complex international data transfer rules.
- **The EU should broaden the scope of the BCR process so it is not limited to intragroup data transfers.** It also should look to find ways to make the process simpler for companies.
- **Removing administrative barriers faced by ICT service providers when they enter EU markets will help to simplify market entry, reduce costs for companies looking to invest, and reduce inefficiencies that impede investment decisions.** For example, before entering each new market, communications service providers often are subject to unnecessarily complex notification procedures before networks and/or services are offered. The relevant authority (BEREC) could consider simplifying such arrangements and standardising them across European markets to encourage greater investment from providers.
- **It is important that EU regulation keeps up to date with M2M developments, so that firms can benefit throughout the single market.** Businesses increasingly view both fixed and mobile M2M technologies as a means to enhance productivity, lower costs, streamline processes, and manage assets and employees. Making appropriate spectrum available and simplifying arrangements for deploying M2M through commercially-driven business models should enable significant development of this technology.

# Conclusion

Europe has recognised that its future economic competitiveness hinges on its ability to embrace a digital economy as quickly as possible. Europe's falling competitiveness since the mid-1990s compared with the US is widely attributed to greater levels of ICT investment in the US combined with conditions and company practices that allow for more efficient exploitation of ICT. The key for the US has been its total factor productivity (TFP) growth—the additional productivity it achieves from the superior ability of some sectors to wring value out of its ICT investments.

Analysing past performance, Oxford Economics is able to quantify the benefits if European economies were to increase their investment in ICT and make (or encourage) changes that would improve the use of ICT. The most important benefits could be:

- Our data suggest that if by 2020 Europe were able to increase its ICT capital stock to the same level (relative to the size of the economy) as that of the US, the level of GDP would increase by 5% on average across Europe, about €760 billion at today's prices, equivalent to €1,500 per person.
- Countries that have underinvested may benefit the most. For example, in Spain and Italy, which have invested only about half as much as the US, the impact on GDP could be more than 7%.

The ability to realise the ICT dividend depends on more than just capital investment. In fact, in many ways the investment in *intangible capital* is more important. Intangible capital covers a broad spectrum of factors, including the skills of the labour force, specific ICT training, and the institutional knowledge that is passed on throughout a company's divisions. The latter can explain why US multinational companies tend to be among the best exploiters of ICT investment. Successful companies see ICT investment as critical to both bringing down costs and generating new business, including driving transformative innovation. For this reason, successful companies invest significant amounts in ICT—even during economic downturns—and are increasingly expected to do so by their investors.

Governments, meanwhile, have a pivotal role to play in fostering ICT investment and use. Oxford Economics' research shows a strong correlation between a government's ICT policy effectiveness and the productivity growth achieved by its economy. Europe's program to achieve a broad range of digital goals—the Digital Agenda—is certainly an important initiative. If the government sets the right conditions, and achieves its legislative agenda to promote market reform, investment will follow.

# Methodology

This white paper, produced in collaboration with AT&T, aims to explain how information and communication technologies (ICT) can help improve productivity and competitiveness in Europe.

The paper looks at the extent to which Europe has fallen behind other regions in its investment in ICT, the impact this may have on income levels and competitiveness, and the productivity boost Europe could see from increasing its ICT investment. It also examines what business leaders and government policy-makers can do to generate productivity gains from ICT investment.

The research has been rigorous and exhaustive. It is built on a combination of data and econometric analysis to establish correlations between ICT investments and productivity levels. We used this data to explore differences in productivity performance between industries and countries and to understand the impact of government policy.

We conducted an in-depth review the following sources:

The EU KLEMS Growth and Productivity Accounts (March 2011), which is financially supported by the European Commission

The Conference Board Total Economy database (January 2011)

In addition to the empirical research, the report draws on economic research conducted over the last two decades, as well as interviews with some of the world's leading business executives, policy-makers, researchers, and analysts. We thank all who took part in the qualitative research.

Clearly there are many factors that affect productivity beyond the use of ICT, such as the use of non-ICT equipment, investment in workforce skills, and labour-market regulation. This report does not seek to address all of these issues, but rather concentrates on the impact of ICT.

Detailed explanations of the data and analysis methods used in this report, together with detailed Q&As with interview participants, are included in the annexes and are available in full online at [www.corp.att.com/bemoreproductive](http://www.corp.att.com/bemoreproductive).

# Annex: Estimating the ICT productivity dividend

This annex provides a brief explanation of the definition and interpretation of productivity measures, and how we derive estimates for the ICT dividend for various European countries.

## Types and uses productivity measures

Productivity growth measures the increase in the volume of output achieved from a given level of input use.

Productivity is commonly measured in one of two ways. Probably the most familiar measure to non-economists is the growth in average labour productivity, which shows the increase over time in the output generated per worker, or for each hour worked. Its main strengths are that it is readily understood and easy to measure.

A drawback is that changes in labour productivity reflect the influences of a host of factors. For instance, it will reflect investment in capital and workforce skills, the influence of organisational change, economies of scale, and variation in the degree of capacity utilisation. As such, the growth in labour productivity does not provide a reliable indicator of advances in technology, which are our primary interest in this report.

Advances in technology are captured by another measure of productivity called total factor productivity, or TFP. TFP measures the increase in the volume of output achieved from a given level of both labour and capital. The term “factor” refers to an input to production, and total factor productivity measures the combined productivity of labour and capital taken together. Conceptually, TFP is directly influenced by technical change, and it is the measure of productivity which is most emphasised in this report.

This study uses data from the EU KLEMS database, which provides detailed output, input and productivity data for the EU27 and a number of other developed economies, such as the United States and Japan. The data are provided at a detailed industry level (either 2-digit or 3-digit ISIC-revision 3).<sup>18</sup>

This study reports analysis of the ICT dividend that uses industry data on real investment in ICT capital and on the level of real ICT capital stock. This is based on EU KLEMS. As investment and capital stock data, however, are not available for all countries included in the EU KLEMS database, our econometric modelling (detailed below) is confined to 13 countries where this data are available.

18 The EU KLEMS database is available at <http://www.euklems.net/>

## Quantifying the ICT-productivity dividend

We follow Cameron, Proudman, and Redding (2005) and estimate a dynamic panel regression. This is explained in the longer technical annex available on the website. We focus on estimating the potential TFP gains generated by ICT investments.

As a first step to calculating the ICT dividend, we use an econometric model to quantify the long-run impact on the level of TFP that follows from a permanent 1% increase in the level of ICT investment. The % TFP impact is reported in Table A1 for 13 economies. Aside from Austria, the largest impacts are for Germany and the UK, where a 1% permanent increase in the level of ICT investment leads to a 0.08% increase in the level of TFP. (While Austria has an estimated impact of 0.16%, it seems more plausible to use the two larger economies as a yardstick for Europe as a whole.) We interpret the 0.08% as a measure of the potential benefit that other European economies could achieve from their ICT investments.

A number of countries have no value reported. These are countries where the model failed to detect a statistical link between ICT investment and TFP (indicated by 'nss'). This failure to detect an ICT impact may indicate that the economy has not yet made the transition to successfully exploiting its ICT impacts. US experience suggests that the transition can be protracted (see main report), so it should not be surprising were some European economies still early in the transition process where significant TFP gains have yet to materialise. Alternatively, the failure to detect an ICT impact may reflect the limitations in the data, either due to a lack of data or possibility due to their quality (TFP is very difficult to measure).

**Table A1: Estimates of the ICT productivity dividend for 13 economies**

Country	Estimates*
Australia	0.03
Austria	0.16
Czech Republic	nss
Denmark	nss
Finland	nss
Germany	0.08
Italy	-0.04
Japan	nss
Netherlands	nss
Spain	-0.08
Sweden	nss
UK	0.08
US	0.05

\* nss: not statistically significant  
Source: Oxford Economics

To calculate the ICT dividend, we multiply the 0.08 impact by the % increase in the gross investment in ICT needed to bring the EU15 economy's ICT capital stock on a par with the US today (30 % of GDP). The investment is assumed to take place over the next decade (by 2020). For the EU15, this requires investment to increase by almost 50% in real terms by 2020, based on a starting level of ICT capital stock of around 20%. We have ICT capital stock data for only nine EU countries, where ICT capital stock averages 22.9%. To derive an EU-wide estimate we assume the capital stock averages 17% of GDP across the other economies (on a par with Italy). Finally, in line with US experience, we assume that the TFP impact is realised in key ICT intensive using industries that account for around 40% of total industry value-added. This together with the 17% assumption for the ICT capital stock for countries where we have no data, are aimed at providing a conservative estimate for ICT dividend. The ICT dividend (1.5% of GDP), is derived by multiplying % change in required investment (48), by ICT impact (0.08), and by industry coverage (0.4).

**Table A2: The ICT dividend and total productivity gain from increasing Europe's ICT capital stock to the same level as the US by 2020**

Country	Divident in 2020		Total impact 2020	
	% GDP	€ Billions (2011 prices)	% GDP	€ Billions (2011 prices)
Austria	1.2	4	3.5	12
France	2.4	56	5.9	139
Germany	1.5	46	4.2	128
Italy	3.3	58	7.8	138
Spain	3.5	44	8.3	103
Sweden	2.9	13	7.1	33
UK	0.2	4	0.5	12
EU	1.5	217	5.0	759

Source: Oxford Economics





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